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Book Announcements

Suzanne Smith and Abraham Kandel, Verification and Validation of Rule-Based Expert Systems (CRC Press, Boca Raton, 1993) 203 pages

Chapter 1: *Introduction.* Quality assurance for expert systems. Background to expert systems. Conventional software and expert systems. A preview of the work. Organization of the book. *Chapter* 2: *The Production of Quality Software.* Introduction. Definition of quality software. Attributes of quality software. Approaches to achieving quality software (Software engineering methodologies. Software quality assurance. Independent verification and validation. Software reviews. Formal proof of correctness. Quality metrics. Configuration management). Application of approaches. *Chapter* 3: *Conventional software development.* Introduction. Verification and validation. Overview of classic life cycle process model (Requirements analysis and definition phase. Design phase. Implementation phase. Testing phase. Maintenance phase). Results of usage. Summary of validation in classic life cycle (Validation testing. Validation test cases. Acceptance criteria. Testing documentation. Revalidation during maintenance phase. Validation tools). *Chapter* 4: *The production of quality expert systems.* Introduction. Definition of quality expert systems. Characteristics of quality expert systems. Approaches to achieving quality expert systems. *Chapter* 5: *Expert System Development.* Introduction. Verification and validation. Overview of expert system process models (Planning phase. Knowledge definition phase. Knowledge design phase. Code and checkout. Knowledge verification. System evaluation). Results of usage. Summary of validation in expert system development (Validation testing. Validation test cases. Acceptance criteria. Testing documentation. Revalidation during maintenance phase. Validation tools). *Chapter* 6: *Issues and Recommendations in Expert System Verification and Validation.* Weaknesses of current practice. Insights from past experience. Difficulties in verification and validation. Overview of recommendations in process model (Planning phase. Knowledge definition phase. Knowledge design phase. Code and checkout. Knowledge verification. System evaluation). Verification and validation recommendations (Validation testing. Validation test cases. Acceptance criteria. Testing documentation. Revalidation. Validation tools). Prevalent questions about verification and validation. *Chapter* 7: *Validation Prototype SAVES.* Introduction and assumptions. Components of SAVES (Validation test manager (Creating test cases. Displaying test cases. Deleting test cases. Executing test cases)). Validation archiver. Validation analyzer and enhancer (Execution analysis. Coverage analysis (Coverage of knowledge base. Coverage of equivalence classes). Test case suggestions)). Evaluation of SAVES. Conclusions. *Chapter* 8: *Conclusions.* Future research topics. Summary.

Abraham Kandel, ed., Fuzzy Expert Systems (CRC Press, Boca Raton, 1992) 316 pages

Chapter 1: *The Evolution From Expert Systems to Fuzzy Expert Systems* (Lawrence O. Hall and Abraham Kandel). *Chapter* 2: *General Purpose Fuzzy Expert Systems* (Mordechay Schneider and Abraham Kandel). *Chapter* 3: *Inferences With Imprecisions and Uncertainities in Expert Systems* (Bernadette Bouchon-Meunier). *Chapter* 4: *On the Representation of Relational Production Rules in Expert Systems* (Ronald R. Yager). *Chapter* 5: *Reduction Procedures for Rule-based Expert Systems as a Tool for Studies of Properties of Expert's Knowledge* (Antonio Di Nola, Witold Pedrycz and Salvatore Sessa). *Chapter* 6: *The Physiology of the Expert System* (A.F. Rocha, F. Giorno, B. Leão and A. Theoto). *Chapter* 7: *On the Processing of Imperfect Information Using Structured Frameworks* (Andrew P. Sage). *Chapter* 8: *Fuzzy Linguistic Inference Network Generator* (Thomas Whalen and Brian Schott). *Chapter* 9: *Advances in Automatic*

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Reasoning Using Possibilistic Logic (Didier Dubois, Jérôme Lang and Henri Prade). *Chapter* 10: *Fuzzy Associative Memory Systems* (Bart Kosko). *Chapter* 11: *The Role of Approximate Reasoning in a Medical Expert System* (D.L. Hudson and M.E. Cohen). *Chapter* 12: *Fess: A Reusable Fuzzy Expert System* (Lawrence O. Hall and Abraham Kandel). *Chapter* 13: *Design for Designing: Fuzzy Relational Environmental Design Assistant (FREDA)* (Vasco Mancini and Wyllis Bandler). *Chapter* 14: *On the Design of a Fuzzy Intelligent Differential Equation Solver* (Menahem Friedman and Abraham Kandel). *Chapter* 15: *MILORD: A Fuzzy Expert Systems Shell* (R. López de Mántaras, J. Agusti, E. Plaza and C. Sierra). *Chapter* 16: *Medical Decision Making Using Multidimensional Polynomials* (M.E. Cohen and D.L. Hudson). *Chapter* 17: *Fuzzy Expert Systems for an Intelligent Computer-Based Tutor.* (Lois W. Hawkes, Sharon J. Derry and Abraham Kandel). *Chapter* 18: *Expert System on a Chip: An Engine for Approximate Reasoning* (Masaki Togai and Hiroyuki Watanabe). *Chapter* 19: *A Probabilistic Logic for Expert Systems* (Arie Tzvieli). *Chapter* 20: *COMEX—An Autonomous Fuzzy Expert System for Tactical Communications Networks* (Mordechay Schneider, Joseph M. Perl and Abraham Kandel).

Adrian A. Hopgood, Knowledge-Based Systems for Engineers and Scientists (CRC Press, Boca Raton, 1993) 387 pages

Chapter 1: *Introduction.* Artificial intelligence. Knowledge-based systems. The knowledge base. Deduction, abduction and induction. The inference engine. Expert systems. Knowledge acquisition. Search. Integration with other software. *Chapter* 2: *Tools and Languages.* Declarative versus procedural programming. Expert system shells. Artificial intelligence toolkits. Artificial intelligence languages. Lisp. Prolog. Pop-11. Comparison of AI Languages. Summary. *Chapter* 3: *Rule-Based Systems.* Rules and facts. A rule-based system for boiler control. Rule examination and rule firing. Maintaining consistency. The closed world assumption. Use of variables within rules. Forward chaining (a data-driven strategy). Conflict resolution. Backward chaining (a goal-driven strategy). A hybrid strategy. Explanation facilities. Summary. *Chapter* 4: *Dealing with Uncertainty.* Sources of uncertainty. Bayesian updating. Certainty theory. Possibility theory-fuzzy sets and fuzzy logic. Other techniques. Summary. *Chapter* 5: *Object-Oriented Systems.* Introduction. An illustrative example. Data abstraction. Inheritance. Encapsulation. Dynamic (or late) binding. Type checking. Message passing and function calls. Class and instance relationships. Further aspects of OOP. Frame-based systems. Summary. *Chapter* 6: *Machine Learning.* Introduction. Symbolic learning by induction. Optimization algorithms. Neural networks. Summary. *Chapter* 7: *Systems for Interpretation and Diagnosis.* Introduction. Deduction and abduction for diagnosis. Depth of knowledge. Case-based reasoning. Model-based reasoning. Case-study: a blackboard system for interpreting ultrasonic images. Summary. *Chapter* 8: *Systems for Desing and Selection.* The design process. Design as a search problem. Computer aided design. The product design specification (PDS): a case study in telecommunications. Conceptual design. Constraint propagation and truth maintenance. Case study: the design of a lightweight beam. Design as a selection exercise. Failure modes effects analysis (FMEA). Summary. *Chapter* 9: *Systems for Planning.* Introduction. Classical planning systems. STRIPS. Considering the side-effects of actions. Hierarchical planning. Postponement of commitment. Job shop scheduling. Constraint-based analysis. Replanning and reactive planning. Summary. *Chapter* 10: *Systems for Control.* Introduction. Low-level control. Requirements of high-level (supervisory) control. Blackboard maintenance. Time-constrained reasoning. Fuzzy controllers. The BOXES controller. Neural network controllers. Statistical process control (SPC). Summary. *Chapter* 11: *Concluding Remarks.* Benefits. How to proceed. Trends. *Index.*

Chris Woodford, Solving Linear and Non-Linear Equations (Ellis Horwood Limited, New York, 1992) 190 pages

Preface. Chapter 1: *Linear Algebra.* Introduction. Vectors. Vector addition. Vector multiplication by a real number. Vector multiplication. Vector spaces. Linear dependence and independence. Basis and dimension for a vector space. Matrices. Special matrices: the unit matrix, the inverse and the transpose. Linear

transformations. Connection between linear transformations of Euclidean space and matrices. Worked example. Exercises. *Chapter* 2: *Linear Equations.* Introduction. Existence and multiplicity of solutions. Necessary condition for a unique solution $A\mathbf{x} = \mathbf{b}$. Necessary condition for a unique solution of $A\mathbf{x} = \mathbf{b}$ for every possible $\mathbf{b}$. Necessary and sufficient condition for $A\mathbf{x} = \mathbf{b}$ to have a unique solution for every possible $\mathbf{b}$. Equivalent statements. Worked example. Exercises. *Chapter* 3: *Gaussian Elimination.* Introduction. Upper triangular systems. Gaussian elimination. The proof of the method. Practical problems. Worked example. Exercises. *Chapter* 4: *Partial Pivoting.* Introduction. Elementary lower triangular matrices. Gaussian elimination in terms of ELTs. Partial pivoting. Worked example. Total pivoting. Scaling. Exercises. *Chapter* 5: *Computer Arithmetic.* Introduction. Integer representation. Real number representation. Floating point value of a real number. Floating point arithmetic. Conclusion. Exercises. *Chapter* 6: *Vector and Matrix Norms.* Introduction. Vector norms. Examples of vector norms. Matrix norms. The induced norm. Examples of consistent matrix norms. Banach's lemma. The fixed point theorem. Exercises. *Chapter* 7: *Error Analysis of Gaussian Elimination.* Introduction. Condition number. Well-conditioned and ill-conditioned matrices. Worked examples. Error analysis of Gaussian elimination. Conclusion. Exercises. *Chapter* 8: *Interpretation of Results.* Introduction. The residual vector. Measuring the residual. Example of an ill-conditioned system. Estimation of conditioning. Iterative refinement. Example. Conclusion. Exercises. *Chapter* 9: *Non-Linear Equations in General.* Introduction. Iterative methods. Convergence. Convergence in general. Practical considerations. Deflation. Order of convergence. Guarantees of convergence, local and global theorems. Exercises. *Chapter* 10: *Single Non-Linear Equations.* Introduction. Bisection. The rule of false position. The secant method. Newton's method. Worked example. Conclusion. Exercises. *Chapter* 11: *Convergence Guarantees.* Introduction. Bisection. Secant method. Newton's method. Fixed point methods. Conclusion. Exercises. *Chapter* 12: *Secant Methods for Systems of Non-Linear Equations.* Introduction. A simple secant method. The method in detail. Worked example. Further secant methods. Broyden's secant method. Worked example, Broyden's method. The Jacobian matrix. Analysis of Broyden's secant method. Local convergence theorem for Broyden's secant method. Conclusion. Exercises. *Chapter* 13: *Newton's Method for Systems of Non-Linear Equations.* Introduction. Newton's method in outline. Newton's method in detail. Worked example. Guarantee of convergence. Order of convergence. Global convergence. Fixed point methods. Conclusion. Exercises.

Krzysztof P. Arczewski and Josef A. Pietrucha, Mathematical Modelling of Mechanical Complex Systems Volume 1 - Discrete Models (Ellis Horwood Limited, New York, 1993) 293 pages

Preface. Chapter 1: *Basic Notions of Modelling.* Model, object, phenomenon. Investigation of phenomena by means of models. An empirical and a casual model. The influence of purpose of modelling on the final form of the model. Discrete and continuous models. Stochastic versus deterministic models. Models related to the differential model. *Chapter* 2: *The Framework for Modelling.* Relationships between mechanics and technology. The fundamental notions of classical mechanics. Selected notions of integrated mechanics. *Chapter* 3: *Modelling by Means of Balance Laws.* Conservation laws versus balance laws. Two introductory examples. Methodology of modelling by means of balance laws. Applications. *Chapter* 4: *Modelling Using Variational Principles.* From Newtonian to variational mechanics. Basic variational principles. Modelling of holonomic systems. Modelling of nonholonomic systems. *Chapter* 5: *Modelling by Means of Graphs.* Basic notions and concepts of graph theory. A brief history of graph theory. The linear graph modelling method. Modelling of rigid-body systems. *Postscript. References. Index.*